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THE MORPHOLOGY, GEOGRAPHICAL DISTRIBUTION AND ECOLOGY OF *HYPNEA SPICIFERA*
(SUHR.) HARV.

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(With Plates XVI and XVII.)

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This report is presented because *Hypnea spicifera* is one of the most important ecological species at intertidal levels over a large part of the South African coast, and because of its possible economic importance. The published information relating to it is scattered and insufficient to give a clear picture. It is one of several species of *Hypnea* occurring in the intertidal zone, but it is much more common than any of the others.

The account given here of the morphology and ecology of the species is chiefly based on observations carried out on plants growing from Richmond (Boknes) to the Great Fish River Mouth and is thus to be regarded as a preliminary account of the species in South Africa as a whole.

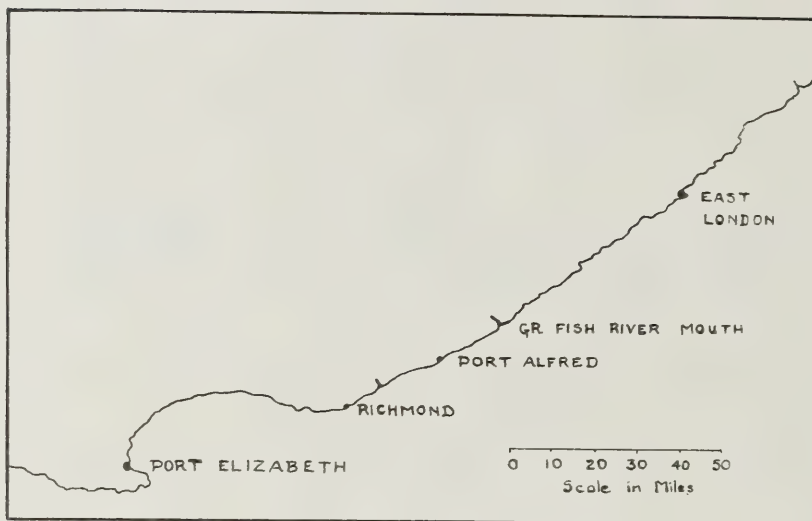


FIG. 1. The coast from Port Elizabeth to East London.

Morphology and Colour.

There are distinct male, female and tetrasporic plants which are of similar morphology and size. Detailed studies at Port Alfred (The Kowie) over a period of a year showed that in that locality tetrasporic and sexual plants occurred at all seasons, though the sexual plants were always found to constitute a very small proportion of the population. This conclusion was supported by additional observations over a stretch of coast from Diaz Cross (approximately six miles east of Richmond) to Fish River Mouth (Fig. 1). Similar studies are needed over other parts of its distribution range.

The plant (Fig. 2) consists of a tuft of erect, cylindrical fronds arising from a creeping prostrate system in character somewhat resembling a bird's nest. This is further dealt with in considering the formation of communities dominated by *Hypnea spicifera*. The erect fronds are densely crowded together and often much branched, giving the plant a bushy appearance. The main axes and branches of the upright fronds have straight tips and more or less pointed apices. Mature fronds are often 30 to 40 cms. (about 12 to 16 inches) long or more, and about 1.5 mm. in diameter near the base. A length of nearly 60 cm. (nearly 2 ft.) has been recorded. Branching is irregular and in all directions. Of the mature

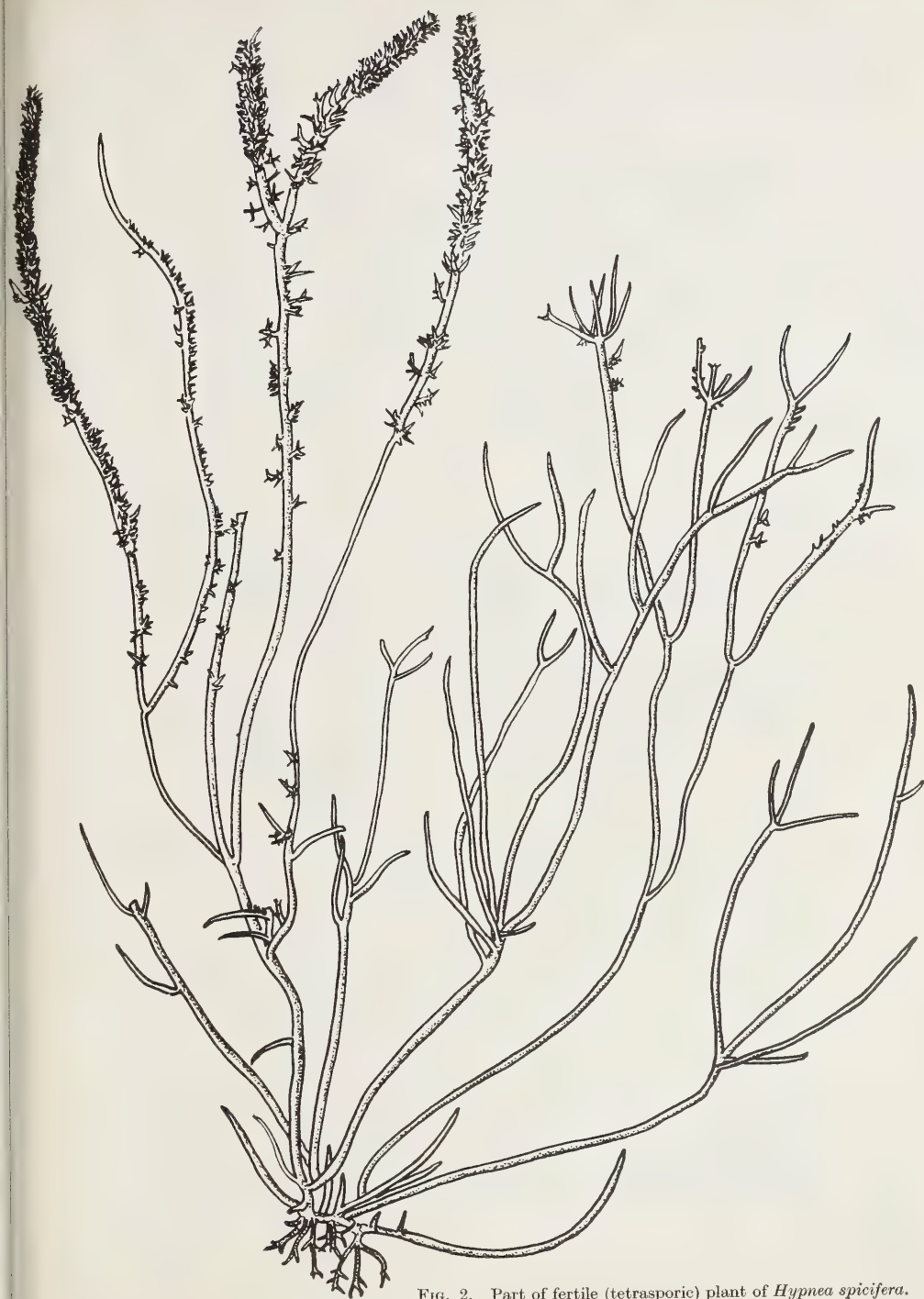


FIG. 2. Part of fertile (tetrasporic) plant of *Hypnea spicifera*.

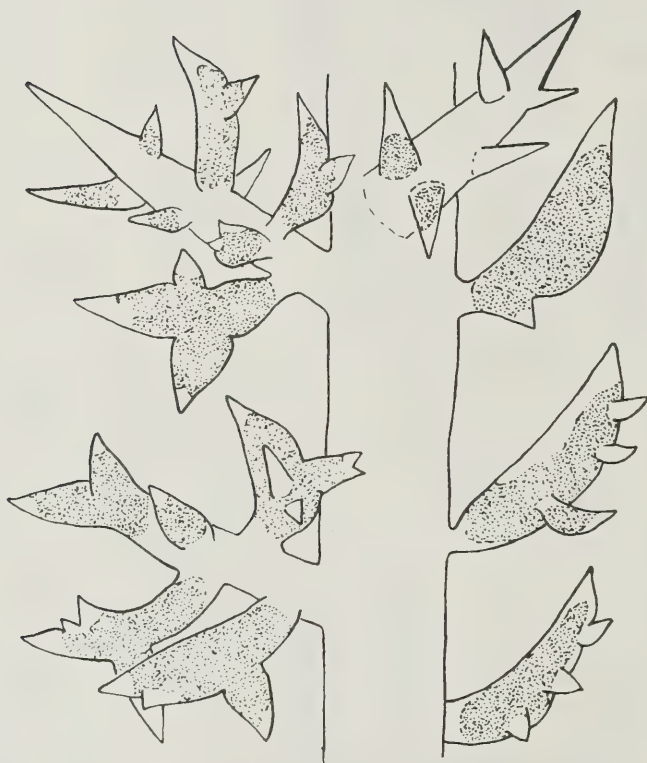


FIG. 3. Enlarged view of fertile region of tetrasporic plant of *Hypnea spicifera*. Stippled areas are fertile parts of stichidia.

fronds the fertile are the more conspicuous, since they are usually several cms. longer than the vegetative fronds and often greater in diameter. The upper portions of the fertile fronds are usually densely covered with numbers of short spinulose branchlets which form a stiff bristle-like covering on the main axes and their branches, extending to within a few millimetres of the tips. These specialised branchlets (stichidia) bear the reproductive organs (Fig. 3). Tetraspores occur in zonate groups within the tissues of the stichidia. The antheridia occur in sori in depressions on the surface of the thallus. Cystocarpic fronds are readily identifiable to the naked eye by the presence of globular fruits about 1 mm. in diameter and bright pink when ripe.

The colour is variable and in the main appears to be related to the level at which the plant grows. Plants in the upper part of the *Hypnea* girdle have short, succulent upright fronds glossy green in colour, with translucent tips. Plants in the lower portion of the girdle have long dark fronds varying in colour from dark olive green to almost black. In the lowest part where wave action is most severe the long blackish fronds are often wiry and sparsely branched. Mature parts of the prostrate system are dark in colour. The young fronds of both the erect and prostrate systems are a pale, semi-translucent pink colour. Fertile fronds, especially cystocarpic fronds, tend to be a more brownish green than the vegetative fronds of the same plant.

Geographical Distribution.

More data are needed before a full and exact picture can be given of the distribution of *Hypnea spicifera* on the coasts of South Africa. The general outlines of the picture, however, are clear on the basis of the data available.

Hypnea spicifera is not endemic but the only record of its occurrence outside the Union known to the writers is at Karachi on the north-west coast of India (Børgesen, 1934). On the coast of the Union it has a very wide distribution (Fig. 4), being one of the most widely distributed seaweeds on South African coasts. It has been recorded from the northern coast of Natal (Umpangazi) to Buffels River within less than 40 miles south of Port Nolloth (Stephenson, 1947).

A bare statement of the geographical range on the Union coasts of such a widely distributed species as *Hypnea spicifera* gives an erroneous impression since the size of the plant and its prominence in the seaweed vegetation varies much within its distribution range. As an important constituent of the seaweed vegetation it has two centres of distribution (Fig. 4):

- (a) From about Boknes (about 50 miles east of Port Elizabeth) to the northern coast of Natal.
- (b) False Bay and the southern end of the west coast of the Cape Peninsula.

The first of these is much more extensive geographically than the second. In fact it is or rather, it includes (as will be shown later) the true centre of distribution. The smaller centre is best regarded as derivative or secondary since locally favourable conditions¹ make it possible for a

¹ For comments and references on ocean currents and sea temperature conditions in South African coastal waters see: Isaac, 1937a and Isaac, 1953a.

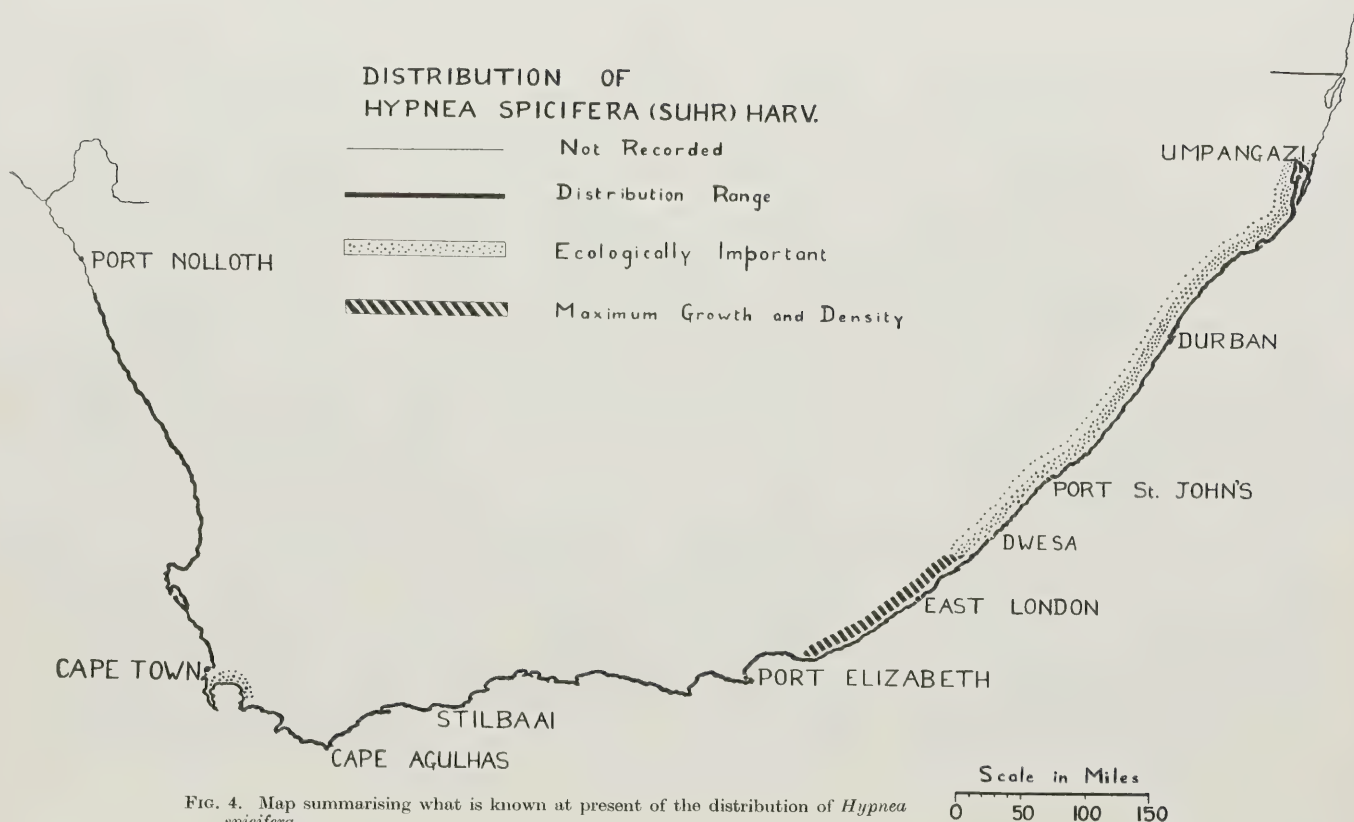


FIG. 4. Map summarising what is known at present of the distribution of *Hypnea spicifera*.

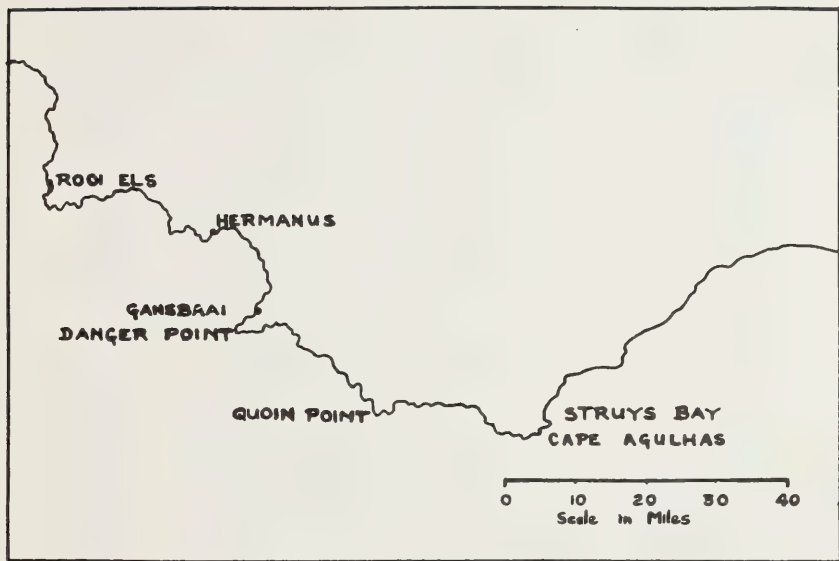


FIG. 5. The Agulhas Peninsula and the coast to the west as far as the eastern end of False Bay.

widely distributed species to become ecologically important in localities distant from the main centre of distribution.

Except at Rheboksdam Bay (Isaac, 1937b), *Hypnea spicifera* is not a species of ecological importance on the west coast where it is rare or occasional. From False Bay to and including Port Elizabeth it shows an erratic distribution but additional information is needed relating to its occurrence along this considerable stretch of coast (about 500 miles). In some localities such as Struys Bay and Agulhas (Fig. 5) it is absent or rare; in other localities, while it is not uncommon it is not one of the common, let alone dominant or sub-dominant, species. Thus at Gansbaai it is a constituent of the mixed algal vegetation of which it is not one of the commonest species; further, the mixed algal vegetation is rather poorly represented and is one of four possible types of algal vegetation at low water level of spring tides, the most common community being the *Bifurcaria* association (Isaac, 1949; 1951).

In other localities such as Frikkie's Baai on the eastern side of Danger Point, Pearly Beach between Quoin and Danger Points, and Hermanus

(Fig. 5) it is a common or locally prominent species. In the Still Bay region *Hypnea spicifera* is listed as one of the algae occurring on an isolated rocky mass and in an annotated list it is marked with an asterisk to indicate that it is a fairly or very common species (Stephenson, Stephenson and du Toit, 1937). As far as our evidence goes, nowhere between False Bay and Port Elizabeth does *Hypnea spicifera* attain the status of a dominant species but this view may have to be modified when more information is available. In the Port Elizabeth district (Port Elizabeth to Chelsea Point), the small amount of this species is a noteworthy feature. It is the converse as it were to the dominance of Corallinaceae and *Laurencia* spp. at the lowest intertidal levels. This point was not made by Stephenson, Stephenson and Bright (1938).

On closer examination of the evidence it becomes clear that *Hypnea spicifera* is not uniform in its ecological status throughout its two centres of distribution. In the secondary centre, the plant flourishes best along the north-western and northern coasts and the northern half of the eastern coast of False Bay. Over this extent of coastline it is dominant in places at the lowest intertidal levels although the *Hypnea* girdle may be a narrow one. Along most of the east coast of the Cape Peninsula to the southern end of the west coast (Rheboksdam Bay) the species is more erratic in its ecological importance since it may be rare, occasional and local, common or very common to locally dominant.

In general, it clearly becomes ecologically more important in a northward direction along the east coast of the Cape Peninsula, attaining optimum development in its secondary centre of distribution along the north-western, northern and eastern shores of False Bay. In regard to its major centre of distribution, *Hypnea spicifera* flourishes best from about Richmond to somewhere between East London and Port St. Johns. At East London this plant is abundant and except in more sheltered situations it is the outstanding dominant species at lower intertidal levels. At Port St. Johns *Hypnea spicifera* is still frequently a dominant species at lowest intertidal levels but there is evidence that it has already extended beyond its region of optimum development. This is seen in its smaller size which does not usually exceed $4\frac{1}{2}$ inches; in a greater degree of intermingling with other species; and in its replacement by other species in moderately sheltered as well as in sheltered situations. The account given by Eyre and Stephenson (1938) makes it clear that in the Durban area the plant has shown a further decline from its optimum condition. It is still smaller in size (less than three inches), it is less important in relation to other species growing at the same intertidal level and is less frequently a dominant species.

Intertidal Position.

Hypnea spicifera occupies the lower part of the intertidal zone where it is emerged at low water of spring tides, although the greater part of the *Hypnea* girdle may be regularly washed by the waves. (Plates XVI and XVII.) The *Hypnea* girdle commonly dominates rocky ridges, the vertical sides of rocky platforms, the walls of gulleys, and the roofs of overhanging ledges. The upper part of the girdle which usually lies above wave action at low water of spring tides may be subjected to constant spray. The lower part of the girdle is almost always subjected to very severe pounding by the waves. *Hypnea spicifera* grows also at corresponding levels on isolated rocks beyond the intertidal belt. It extends into the sublittoral to only a limited extent. It is not typically a rock pool species, but where it occurs it grows just below the surface of the water. It is always attached to a firm substratum, usually to rock, sometimes to mussels. It can withstand being partially buried in sand.

Ecological Status.

In the region of optimum development *Hypnea spicifera* not only dominates, but forms almost pure communities. This can be accounted for by certain features of the prostrate system. This system consists of an intricate network of creeping axes, from which numerous branches spread out in all directions covering the substratum. These creeping axes are anchored by minute, more or less circular discs (haptera) which arise at irregular intervals from the branches. (Fig. 6.) Numbers of

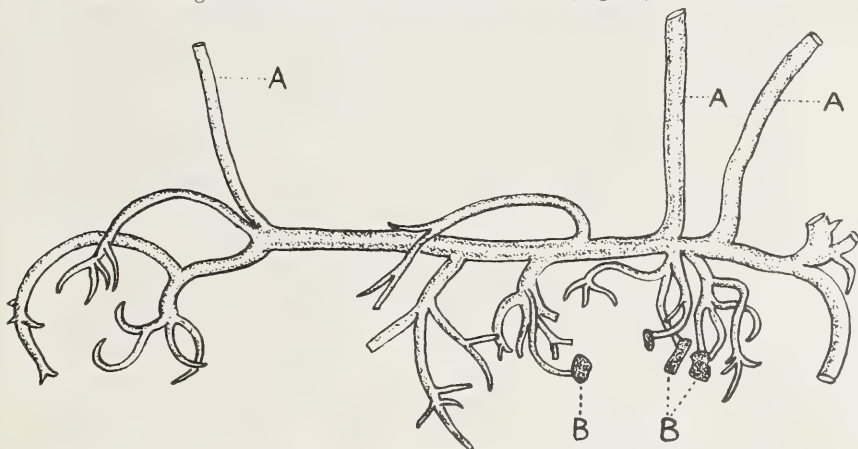


FIG. 6. Small part of basal region of *Hypnea spicifera*.

A. Bases of erect fronds.

B. Sand grains adhering to discs.

erect fronds develop from the creeping axes. By this form of vegetative growth the *Hypnea* community not only spreads extensively but is built up in an almost pure state. It would thus appear that the plant is only partly dependent on reproduction by tetraspores and sexual cells.

As explained above, under optimum conditions of sea temperature and exposure, *Hypnea spicifera* forms dense communities which are almost pure, other species being crowded out. In this respect these communities recall those of *Bifurcaria brassicaeformis* (Isaac, 1951). Even under optimum conditions there may be some admixture of species at the seaward limits of the *Hypnea* girdle. Thus at East London, one or more of the species *Gelidium cartilagineum*, *G. rigidum*² and *Ecklonia biruncinata* grow alongside *Hypnea spicifera* at its lowest levels. Again at Port Alfred, clans of *Chondria* sp. occur in and about the *Hypnea* girdle as well as to some extent growing among plants of *Hypnea spicifera*.

Where conditions are less favourable, *Hypnea spicifera* forms a constituent of a mixed algal vegetation. It occurs thus at Gansbaai and Hermanus (Isaac, 1949) but in neither locality is it one of the commonest species. At Rooi Els it is sometimes co-dominant with *Gelidium cartilagineum*. In moderately sheltered places at Port St. Johns *Hypnea spicifera* may occur as one of a number of species.

Occurrence in Relation to Exposure.

Over most of its geographical range, *Hypnea spicifera* flourishes best in exposed situations where it withstands considerable battering from the sea. This is most obvious in its major centre of distribution. At East London, Dwesa and Port St. Johns it is chiefly replaced by *Caulerpa racemosa* var. *zeyheri* in less exposed situations. At Fish River Mouth, *Hypnea spicifera* is replaced in more sheltered places by *Caulerpa filiformis*. At its western limits of distribution as an ecologically significant species there are indications that *Hypnea spicifera* favours more sheltered situations or is at least more tolerant of them. In this connection it might be noted that in the very exposed places at Hermanus (Kwaaiwater) it is *Plocamium cornutum* and not *Hypnea spicifera* that is the most characteristic species, the latter occurring as a member of the mixed algal vegetation in less exposed situations (Isaac, 1949). Further, most of the secondary centre of distribution occurs in False Bay. It is true that the chief reason why *Hypnea spicifera* flourishes in the more northern parts of False Bay is the higher sea temperatures but it should be noted that False Bay is also a region of relatively calm waters.

² See note, Isaac, 1953a, appendix.

SUMMARY.

The male, female and tetrasporic plants of *Hypnea spicifera* (Suhr) Harv. are morphologically similar. The plant varies from less than three inches to about 16 inches and more in height and from a bright green to dark olive green, almost black colour. Size and colour variations are related to geographical and ecological factors. Fertile plants are somewhat longer than purely vegetative plants and bear numerous small fertile branchlets (stichidia). The plant consists of an extensive, richly branched prostrate part from which numerous upright richly branched fronds arise. The prostrate part bears numerous small discs by means of which the plant adheres to a hard substrate, usually rock.

Hypnea spicifera, which is of possible economic importance, is distributed over almost the entire extent of the Union coastline but is of ecological importance only in warmer waters. Except locally at the very southern end, it is a rare or occasional species on the west coast which is subject to the influence of the cold Benguela Current. It is ecologically important from a little east of Port Elizabeth (about Boknes) northwards along the east coast of the Union. Along the whole of this coastline it is subject to the influence of the warm Agulhas Current, sea temperatures increasing in a northward direction. In the southern part of this stretch of coast it shows a luxuriant growth and dominates a low intertidal level to the practical exclusion of other species except in sheltered situations. To the north, while remaining an ecologically important species it becomes smaller in size and less important in the seaweed vegetation.

Abnormally high sea temperatures in False Bay immediately east of the Cape Peninsula are correlated with a secondary centre of distribution along the northern and eastern shores of the bay, where *Hypnea spicifera* again becomes a common or dominant species, although the *Hypnea* girdle is often narrow.

Hypnea spicifera occurs to some extent in pools and in the sublittoral but it is chiefly found at the lowest intertidal levels. Over the greater part of its distribution range it flourishes in exposed situations. Under optimum conditions it forms dense almost pure communities, this being facilitated by the creeping prostrate part of the thallus. Along other parts of the coast it may be locally dominant or it may be a constituent of greater or lesser importance in a mixed algal vegetation.

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LITERATURE.

- BORGESSEN, F. (1934): "Some Marine Algae from the northern part of the Arabian Sea with remarks on their Geographical Distribution", *Det. Kgl. Danske Videnskabernes Selskab Biologiske Meddelelser*, vol. XI, 6.
- EYRE, J. and STEPHENSON, T. A. (1938): "The South African Intertidal Zone and its relation to Ocean Currents. V. A Sub-tropical Indian Ocean Shore," *Ann. Natal Museum*, vol. IX, p. 21.
- ISAAC, WM. EDWYN (1937a): "South African Coastal Waters in relation to Ocean Currents," *Geogr. Rev.*, vol. 27, p. 651.
- (1937b): "Studies of South African Seaweed Vegetation. I. West Coast from Lambert's Bay to the Cape of Good Hope," *Trans. Roy. Soc. S. Africa*, vol. 25, p. 115.
- (1949): "Studies of South African Seaweed Vegetation. II. South Coast: Rooi Els to Gansbaai, with special reference to Gansbaai," *Ibid*, vol. 32, p. 125.
- (1951): "Observations on the Ecology of *Bifurcaria brassicaeformis* (Kütz.) Barton," *Jour. Ecology*, vol. 39, p. 94.
- (1953): "South African Seaweed Vegetation and future investigations in this field," *Journ. S. African Botany*, vol. XIX, p. 59.
- STEPHENSON, T. A. (1947): "The Constitution of the Intertidal Fauna and Flora of South Africa, Part III," *Ann. Natal Mus.*, vol. XI, p. 207.
- STEPHENSON, T. A. and A., and BRIGHT, K. M. F. (1938): "The South African Intertidal Zone and its relation to Ocean Currents. IV. The Port Elizabeth District," *Ibid*, vol. 9, p. 1.
- STEPHENSON, T. A. and A., and DU TOIT, C. A. (1937): "The South African Intertidal Zone and its relation to Ocean Currents. I. A Temperate Indian Ocean Shore," *Trans. Roy. Soc. S. Africa*, vol. XXIV, p. 341.

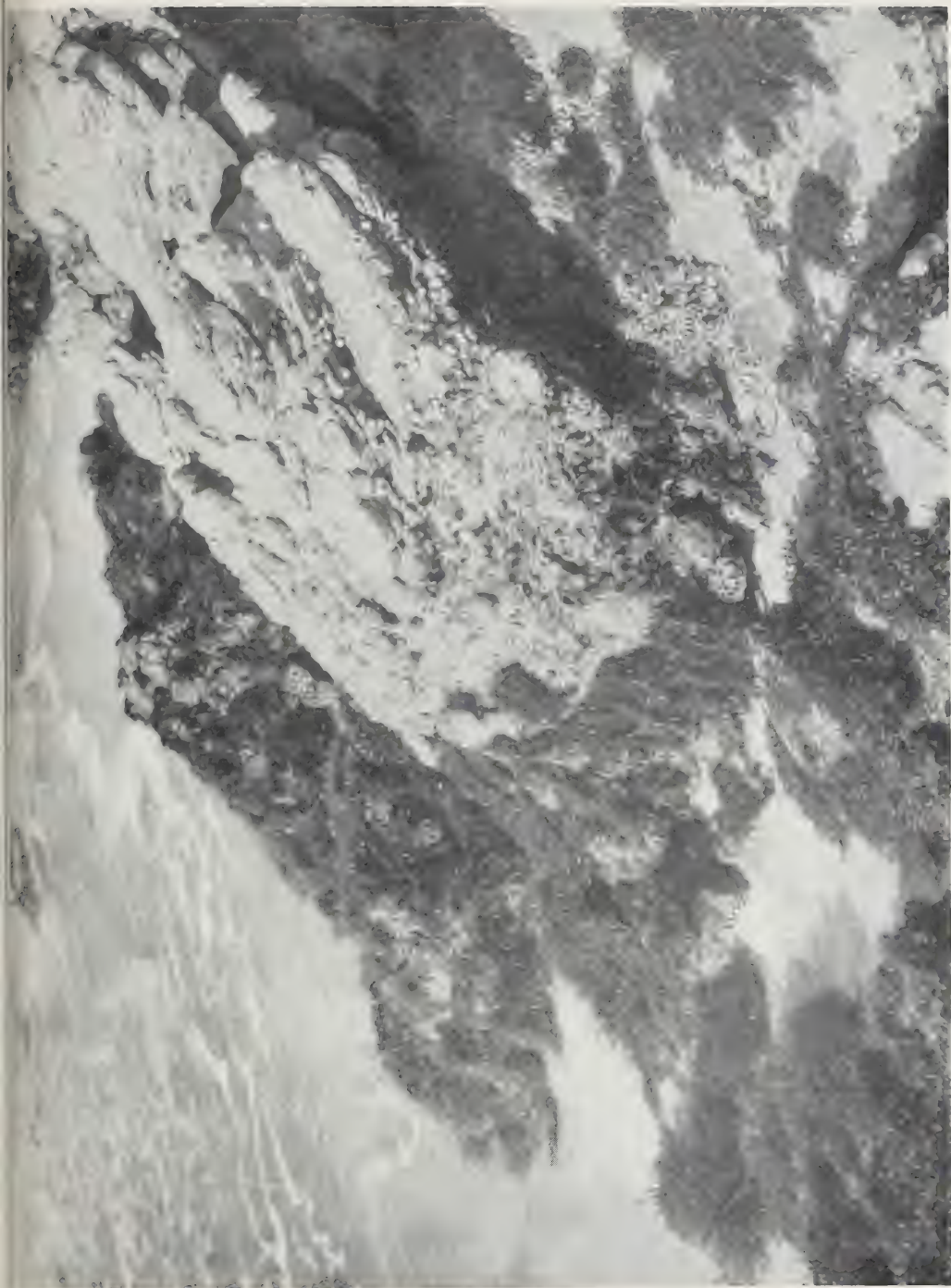


PLATE XVI. *Hypnea* girdle at Salt Vlei (Kowie West): Port Alfred region.

PLATE XVII. *Hypnea grisea* in a gully at an angle to the open sea at Salt Vlet (Kowle West); Port Alfred region.

